REMARKS UNDER 37 CFR § 1.111

Formal Matters

Claims 1-32 are pending after entry of the amendments set forth herein.

Claims 1-32 were examined. Claims 1-32 were rejected.

Please replace claim 1 with the clean version provided above.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE**."

Applicants respectfully request reconsideration of the application in view of the amendments and remarks made herein.

No new matter has been added.

The Office Action

In the Official Action of September 3, 2002, the Examiner objected to the drawings and required that "the logic" be shown in the drawings. In response thereto, Application have submitted a Request for Approval of Proposed Drawing Corrections herewith, together with marked up copies of Figs. 2A and 9 showing the requested changes in red, i.e., showing logic 254L, 248L and 900L. The Examiner is respectfully requested to indicate approval of the requested drawing changes in the next Official communication.

The Examiner requested correction of minor errors in the specification. Applicants have made such amendments to the specification above.

Claims 1-28 were rejected under 35 U.S.C. Section 112, second paragraph as being indefinite. The Examiner asserted that claim 1 was incomplete for omitting essential elements, and that the elements which were omitted were front and rear facets, gain medium/laser amplifier, and lens. Claims 2-28 were rejected for depending from claim 1. In response thereto, Applicants respectfully traverse this ground of rejection, and submit that rear facets, gain medium and lens are not essential elements of the claimed invention. The claimed invention is to a tunable filter for use in optical communication apparatus. As such, the claimed invention may be implemented in an external cavity laser, which would include the elements that the Examiner has referred to. However, the claimed invention is also useable in an add/drop multiplexor, as shown in Fig. 8, and a wavelength locker, as shown in Fig. 9, among

other uses that do not necessarily require the elements identified by the Examiner. Claim 1 has been amended above to further clarify that the claimed invention is a tunable filter for use in optical communication apparatus. As such, it is respectfully submitted that claim 1, as amended, is clear and definite and does not require inclusion of the additional elements identified by the Examiner. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 1-28 under 35 U.S.C. Section 112, second paragraph as being indefinite, as being no longer appropriate.

Claims 1-28 were further rejected under 35 U.S.C. Section 112, second paragraph as being incomplete for omitting essential structural cooperative relationships of elements. In response thereto, Applicants have amended claim 1 to further recite that the elements are mounted for optical alignment in an optical beam. Thus, the elements are mounted coaxially with an optical path of the optical apparatus in which they are used, which is supported by the specification at page 8, lines 30-31, for example. In view of the above amendment of claim 1, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 1-28 under 35 U.S.C. Section 112, second paragraph as being incomplete, as being no longer appropriate.

Claim 1 was rejected under 35 U.S.C. Section 102(e) as being anticipated by Avrutsky et al. The Examiner asserted that Avrutsky et al. teaches a tunable filter apparatus comprising a grid generator 72 and a channel selector 74. Application respectfully traverse this ground of rejection. In order to be an anticipatory reference under 35 U.S.C. Section 102, the reference must disclose, or inherently possess each and every feature recited in the claims. Avrutsky et al. discloses a superimposed grating tunable WDM semiconductor laser, wherein the grating structure is a binary superimposed grating having a plurality of segments of equal dimension. Each segment has one of two values of refractive index, so that the grating structure is provided by a binary modulation of segments s along the length of the grating. The grating pattern, defined by a grating structure of two index values, gives a resulting pattern that looks like an irregular binary sequence. Avrutsky et al. fails to disclose or inherently possess a tunable filter comprising a grid generator having a first selected optical path length determinative of a first free spectral range substantially corresponding to a spacing between adjacent gridlines of the selected wavelength grid, and a channel selector having a tunable second optical path length determinative of a second free spectral range differing from the first free spectral range by an amount corresponding substantially inversely with the number of channels of the selected wavelength grid, as recited in claim 1. There is no disclosure or suggestion of providing a channel selector having an optical path length as characterized in claim 1. For at least these reasons, the Examiner is respectfully requested

to reconsider and withdraw the rejection of claim 1 under 35 U.S.C. Section 102(e) as being anticipated by Avrutsky et al., as being inappropriate.

Claims 1-7, 9-12, 15 and 22-32 were rejected under 35 U.S.C. Section 102(e) as being anticipated by Sesko et al. The Examiner asserted that Sesko et al. teaches a tunable filter apparatus in Fig. 2A which includes a grid generator 4 and a channel selector 5. Applicants respectfully submit that Sesko et al. fails to disclose or suggest each and every feature recited in claim 1. Sesko et al. discloses a liquid crystal tuned external cavity diode laser. Sesko et al. specifies that liquid crystal tuning is essential to the low power requirements of the invention. In Fig. 2A, the liquid crystal etalon 5 serves as the course tuning element of the laser, and discriminates between the peaks defined by the solid etalon 4. Although Sesko et al. indicates that the liquid crystal etalon 5 needs to have FWHM bandwidth that is less than the free spectral range of the solid etalon 4, Sesko et al. fails to disclose teach or suggest the provision of a channel selector having a tunable second optical path length determinative of a second free spectral range differing from the free spectral range of the grid generator by an amount corresponding substantially inversely with the number of channels of the selected wavelength grid, as recited in claim 1.

Accordingly, it is respectfully submitted that Sesko et al. fails to anticipate claim 1. It is further respectfully submitted that Sesko et al. fails to anticipate claims 2-7, 9-12, 15 and 22-28 for at least the same reasons, since these claims depend from claim 1. It is still further respectfully submitted that claims 29-32 are not anticipated by Sesko et al., as these method claims recite the limitation of tuning with a second free spectral range differing from the first recited free spectral range by an amount corresponding substantially inversely with the number of channel of the recited selected wavelength; a feature which is neither disclosed nor suggested by Sesko et al. For at least the foregoing reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 1-7, 9-12, 15 and 22-32 under 35 U.S.C. Section 102(e) as being anticipated by Sesko et al., as being inappropriate.

Claims 8, 13-14 and 16-21 were rejected under 35 U.S.C. Section 103(a) as being unpatentable over Sesko et al. It is respectfully submitted that these claims are allowable over Sesko et al. for at least the same reasons provided above with regard to claim 1, since these claims depend from claim 1. Further, with regard to claim 8, the Examiner asserted that it would have been an obvious matter of design choice to replace the liquid crystal Fabry-Perot interferometer, the wavelength of which is changed by changing the voltage applied thereto, with a mechanical actuator for tuning a channel selector. Applicants respectfully disagree. Sesko et al. teaches against such a substitution by disclosing

that mechanically tuned systems are not ideal for use in hand held battery operated devices, and by disclosing that liquid crystal filters require only tens of volts to tune over a large range and may be powered by using conventional batteries, see col. 1, lines 61-65; col. 3, lines 1-4 and col. 4, lines 25-28.

For at least the above reasons, the Examiner is respectfully requested to reconsider and withdraw the rejection of claims 8, 13-14 and 16-21 under 35 U.S.C. Section 103(a) as being unpatentable over Sesko et al., as being inappropriate.

Conclusion

Applicants submit that all of the claims are in condition for allowance, which action is requested. If the Examiner finds that a telephone conference would expedite the prosecution of this application, please telephone the undersigned at the number provided.

The Commissioner is hereby authorized to charge any underpayment of fees associated with this communication, including any necessary fees for extensions of time, or credit any overpayment to Deposit Account No. 50-0815, order number NUFO-021CON.

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

The first paragraph beginning on page 1, line 4 was amended as follows:

(Amended) The application is continuation of U.S. Application Serial No. 09/626,526 filed July 27, 2000, pending, which claims benefit of U.S. Provisional Application 60/145,831 filed on July 27, 1999, all of which are hereby incorporated by reference thereto, in their entireties, and to which this application claims priority under 35 U.S.C. Section 120.

The paragraph beginning on page 8, line 17, was amended as follows:

(Amended) Structurally, the tunable laser is shown laid out along an optical path 208. Coupling optics 212 are positioned between the back facet 226 of the laser 224 and a fiber optic 206. The laser and coupling optics are mounted to the base 260 by individual mounts 222 and 210 respectively. The fiber optic is coupled by ferrule 204 to an optical coupler 202 which is in turn coupled to base 260. The laser amplifier, in an embodiment of the invention, is a conventional Fabry-Perot laser diode. The front and rear facets 228-226 of the laser diode are aligned with the longitudinal axis 208. The front facet has an AR coating with a reflectivity of less than 0.5%. The rear facet in this embodiment includes a partially reflecting dielectric coating. The proximal end of the external cavity is located at the front facet 228 of the laser diode. The distal end of the external cavity is defined by the retroreflector [222] 264. The cavity itself extends from the rear facet of the gain medium to the retroreflector. The retro reflector 264 is coupled to base 260 via mount 262.

The paragraph beginning on page 10, line 18, was amended as follows:

(Amended) In this embodiment the channel selector includes a gas or solid etalon 252. The etalon includes opposing planar first and second reflectors which are highly reflective, e.g., ($FSR_{Channel\_Selector}$) differing from that of the grid generator (FSR_{Grid_Gen}) by an amount corresponding

substantially inversely with the number of channels in the wavelength grid. Both free spectral ranges of the grid generator and channel selector are broader than the free spectral range of the cavity (FSR_{Cavity}) (See FIG. 4A-B and FIGS. 5A-C). In an embodiment of the invention, the FSR of the channel selector differs from the FSR of the grid generator by an amount which substantially corresponds to the quotient of the channel spacing and the number of channels in the wavelength grid, e.g., an ITU grid (See FIG. 4A-B and FIGS. 5A-C). Vernier tuning of the channel selector results in a single loss-minimum within the communications band which can be tuned across the grid. The combined feedback to the gain medium from the grid generator together with the channel selector supports lasing at the center

The paragraph beginning on page 11, line 14, was amended as follows:

(Amended) The temperature control of the device may include individual temperature control of: the grid generator 246, the base 260, and the gain medium 224. The channel tuner and the grid control include logic 254C, 248C for tuning the channel selector 252 and for maintaining the reference characteristics of the grid generator 246 respectively. These modules may be implemented separately or in combination. They may be implemented with open or closed loop feedback of temperature, wavelength, position etc. A single processor with appropriate program code and lookup table(s) may be used to control both the channel tuner and grid control. In an embodiment of the invention the lookup table contains data or formula which correlate wavelength of either/both the channel selector 252 or the grid generator 246 with the control variable(s). In the above discussed embodiment the control variable is temperature. In alternate embodiments of the invention the control variable(s) include: position, rotation, temperature, electrical parameters, electro-optic parameters etc. The lookup table(s) may contain a formula or a plurality of records which correlate the pass band characteristics of either or both the channel selector and the grid generator with a specific control variable, e.g. tuning parameter, appropriate for the manner in which selector / generator is being tuned/regulated. Tuning/regulation may be accomplished by mechanical, electrical or opto-electrical tuning device. Mechanical parameters include positions of the channel selector, (See FIG. 3A).

The paragraph beginning on page 23, line 3, was amended as follows:

(Amended) FIG. 9 is a block diagram of an alternate embodiment of the vernier tuned filter as

part of a wavelength locker. A optical beam source 900 is shown emitting an output beam 904. That beam may include a number of channels each centered on a corresponding gridline of a selected wavelength grid. That beam passes through a beam splitter 910 to generate an output beam 906 and a reference beam 908. The reference beam passes through a first [phototetector] photodetector 920 and a second photodetector 922. Between the first and second photodetectors is positioned the vernier tuned filter generally 290. That filter is tuned in the above discussed manner to a selected wavelength at which to measure one or more of the input wavelengths of the beam. The drift of the output wavelength of the laser is measured at the second photodetector. Differencer 924 accepts as inputs the signal provided by the photodetectors 920-922. The photodetectors in combination with the differencer comprise an error detector to detect a difference in energy levels of the beam at the input and output of the vernier tuned filter and to provide an output in the form of an error signal. The error signal, may be subject to amplification in amplifier 926 and is supplied to the laser 900 and to logic 900C therein [(not shown)] for adjusting a wavelength control parameter of the laser, e.g. drive current. In an embodiment of the invention, where the control parameter is current, the output of the amplifier may be coupled to logic which includes a summer which sums the error signal and a laser drive signal to drive the laser.

IN THE CLAIMS

Claim 1 was amended above as follows:

1. (Amended) A [In a communication apparatus, an improvement of] tunable filter for use in optical communication apparatus, said tunable filter being tunable to each selected center wavelength of a number of channels, and each of the channels centered on a corresponding gridline of a selected wavelength grid; said tunable filter comprising:

a grid generator [suitable for positioning] mounted for optical alignment in an optical path of a beam, and the grid generator of a first selected optical path length determinative of a first free spectral range substantially corresponding to a spacing between adjacent gridlines of the selected wavelength grid; and

a channel selector [suitable for positioning] mounted for optical alignment in the optical path of the beam, and the channel selector with a tunable second optical path length determinative of a second free spectral range differing from the first free spectral range by an amount corresponding substantially

inversely with the number of channels of the selected wavelength grid and said second optical path length tunable to a selected one of the number of channels of the wavelength grid.